

Example 13: Determine the escape velocity for any space shuttle launched from the surface of Mars, which has a planetary mass of 6.40×10^{23} kg and a radius of 3.4×10^6 m.

$E_T = 0 \rightarrow$ object has enough speed to reach infinity so that

$$E_p = 0 \text{ \& } E_k = 0$$

\therefore at launch, $E_p + E_k = 0$

$$- \frac{GMm}{r} + \frac{1}{2}mv^2 = 0$$

$$\frac{1}{2}v^2 = \frac{GM}{r}$$

$$v = \sqrt{\frac{2GM}{r}}$$

$$= \sqrt{\frac{2(6.67 \times 10^{-11})(6.4 \times 10^{23})}{3.4 \times 10^6}}$$

$$v = 5.0 \times 10^3 \text{ m/s}$$